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1 VACUUM DEPOSITION DEVICE
Inventor: TAKATSU KAZUMASA; TAKAKURA HIDEO; **Applicant:** CANON KK (+1)
EC: **IPC:** ***G09F9/00; C23C14/04; C23F4/00*** (+10)
Publication info: JP2000328229 A - 2000-11-28

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Publication number: JP2000328229
Publication date: 2000-11-28
Inventor: TAKATSU KAZUMASA; TAKAKURA HIDEO; UENO KAZUNORI
Applicant: CANON KK
Classification:
- International: ***G09F9/00; C23C14/04; C23F4/00; H01L51/50; H05B33/10;*** **G09F9/00; C23C14/04; C23F4/00; H01L51/50; H05B33/10;** (IPC1-7): C23C14/04; C23F4/00; G09F9/00
- European:
Application number: JP19990139110 19990519
Priority number(s): JP19990139110 19990519

Abstract of **JP2000328229**

PROBLEM TO BE SOLVED: To provide a vacuum deposition device capable of easily removing an organic film or an organometallic film deposited on a masking plate. SOLUTION: In a vacuum deposition device having an evaporation source, capable of vaporizing an organic material or an organometallic material from the evaporation source and using a masking plate in order to deposit an organic film or an organometallic film on only specified part of a base plate, a means, which is able to remove the organic film or the organometallic film deposited on the masking plate by vacuum deposition in the presence of plasma, is provided.

CLAIMS

[Claim(s)]

[Claim 1] In the vacuum deposition equipment which uses the masking board which is equipped with an evaporation source, evaporates an organic material or organic metal material from this evaporation source, and makes an organic film or an organic metal film deposit only on the specific part on a substrate Vacuum deposition equipment characterized by providing a means to remove the organic film or organic metal film deposited on the masking board by vacuum deposition under existence of plasma.

[Claim 2] Vacuum deposition equipment according to claim 1 which consists of a means to remove the organic film or organic metal film which introduced the gas containing oxygen and supplied electric power in the electric power which makes a masking board generate plasma, and said means made generate plasma and deposited only around said masking board at the masking board.

[Claim 3] Said means introduces the gas containing oxygen and the electrode for generating plasma in addition to a masking board is prepared. Vacuum deposition equipment according to claim 1 which consists of a means to remove the organic film or organic metal film which impressed bias to the masking board, was made to generate plasma only around said masking board, and was deposited on the masking board.

[Claim 4] Vacuum deposition equipment given in one clause of the Claims 1-3 which have the shutter which prevents penetration of the oxygen radical generated by the plasma for removing the organic film or organic metal film which said evaporation source deposited on the masking board.

[Claim 5] Vacuum deposition equipment according to claim 1 said organic material or whose organic metal material is a charge of organic electro RUMINESSENSUDI spray material.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to the membrane formation equipment which uses masking boards, such as an organic electro RUMINESSENSUDI spray which needs masking membrane formation, about vacuum deposition equipment.

[0002]

[Description of the Prior Art] As for the organic electroluminescence element (it is hereafter described as an organic EL device) which is spontaneous Optical Devices Division, research and development have been furthered towards the use to a small display etc. in recent years. However, if the wall of a liquid crystal panel must be smashed for expansion of the market and the predominancy in particular of power consumption reduction is not secured, it is difficult to expand the market. Then, the panel for automobile loading attracts attention. Organic electroluminescence is spontaneous light, even place [where it is dark even place / bright], visibility is high, and since it is an object for automobile loading, the problem of power consumption is also solved.

[0003] Generally, the deposition film of an organic EL device has indispensable patterning by the membrane formation technology which used for manufacture of a display especially the masking board which has an opening, although membranes are respectively formed on a substrate by the vacuum deposition method or the weld slag method.

[0004] However, if an organic film accumulates on a masking board while having repeated membrane formation, the opening of said masking will raise a **** ball, or a pattern gap occurs under the influence of a deposition film, and it becomes the poor cause of an element. Opening a vacuum chamber wide to the atmosphere, taking out said masking board generally [in order to prevent this], and removing an organic film, or exchanging for a new masking board is performed. The method of removing an organic film is the reproduction method of a masking board with common shaving off an organic film by the method of taking out to the atmosphere and melting an organic film by the organic solvent, and a method like blast processing.

[0005] Moreover, etching gas is passed, plasma is generated and the method of etching a film (remains output) is performed as the removal method of the deposition film in the inside of the vacuum in the conventional vacuum processing unit is indicated by JP,H8-319586,A, for example. Generally this method is used for film removal of the plasma CVD equipment which had an electrode for plasma generating in the vacuum chamber, and an etch apparatus, and removal of a by-product. However, it is not used for the vapor deposition equipment which has membrane formation material in a vacuum chamber and which uses sputtering equipment and an evaporation source crucible. This is because the reactant gas of the material in the charge of a target material by which bonding was carried out, or a crucible will be radical to a cathode

and it will be etched into it.

[0006]

[Problem to be solved by the invention] However, there were the following problems in once opening the conventional vacuum chamber wide to the atmosphere, and performing organic film removal of a masking board, and the equipment which passes reactant gas in a vacuum, is made to generate plasma, and performs film removal.

[0007] 1. Generally, if an organic material is hygroscopic and neither the ** gas of material nor drying is fully performed, as for the organic EL device etc., it is known that a life will fall remarkably. Once it opens a vacuum chamber to the atmosphere, the time for returning to a membrane formation state (state which removed moisture of a vacuum chamber or an organic material) again will need, and manufacturing efficiency will fall.

2. When a masking board is exchanged, it is necessary to perform position ****** of a masking board each time. It is necessary to carry out position ****** of this work in the accuracy of several [tens to] microns, and to attach a position adjustment mechanism.

3. [if Gas Containing Oxygen Etc. is Introduced into Processing Room, Plasma is Generated in Parallel Plate Electrode for Making the Processing Interior of a Room Generate Plasma and Organic Film is Removed, Surface Exposed to Plasma of a Built-in Thing of the Processing Interior of a Room, for Example Inner Wall of Processing Room, Will be Washed, but] It was difficult to remove the organic film which the masking **** edge part of the side in contact with 2mm in thickness of a masking board, the side wall of the slot of a flute width the unit of 1/10mm, or a substrate deposited. After all, since washing of the slot side wall part of a masking board to wash most is imperfect even if built-in things other than a masking board are washed by plasma, the defective fraction of an organic EL device does not decrease.

4. If plasma tends to remove an organic film, to an organic material in a crucible, reactant gas will be radical and it will etch.

[0008] This invention is made in order to improve the fault of such conventional technology. In the vacuum deposition equipment using the masking board which evaporates an organic material or organic metal material, and makes an organic film or an organic metal film deposit only on the specific part on a substrate from an evaporation source It aims at offering the vacuum deposition equipment from which the organic film or organic metal film deposited on said masking board can be removed easily without moreover breaking a vacuum.

[0009]

[Means for solving problem] Namely, this invention is equipped with an evaporation source, evaporates an organic material or organic metal material from this evaporation source, and is set to the vacuum deposition equipment which uses the masking board which makes an organic film or an organic metal film deposit only on the specific part on a substrate. It is vacuum deposition equipment characterized by providing a means to remove the organic film

or organic metal film deposited on the masking board by vacuum deposition under existence of plasma.

[0010] Said means (the reproduction means or cleaning means of a masking board) introduces the gas containing oxygen. It is desirable to consist of a means to remove the organic film or organic metal film which supplied electric power in the electric power which makes a masking board generate plasma, was made to generate plasma only around said masking board, and was deposited on the masking board.

[0011] Said reproduction means or a cleaning means introduces the gas containing oxygen, and the electrode for generating plasma in addition to a masking board is prepared. It is desirable to consist of a means to remove the organic film or organic metal film which impressed bias to the masking board, was made to generate plasma only around said masking board, and was deposited on the masking board.

[0012] It is desirable to have the shutter which prevents penetration of the oxygen radical generated by the plasma for removing the organic film or organic metal film which said evaporation source deposited on the masking board. It is desirable that said organic material or organic metal material is a charge of organic electro RUMINESSENSUDI spray material.

[0013]

[Mode for carrying out the invention] [vacuum deposition equipment equipped with masking board reproduction or the cleaning mechanism of this invention] In the vacuum deposition equipment which uses the masking board which is equipped with an evaporation source, evaporates an organic material or organic metal material from this evaporation source, and makes an organic film or an organic metal film deposit only on the specific part on a substrate. It is characterized by providing a reproduction (or cleaning) means to make only the field inner circumference neighborhood field of said masking board generate plasma, and to remove in a vacuum the organic film or organic metal film deposited on the masking board by vacuum deposition.

[0014] The vacuum deposition equipment of this invention is equipped with the removal means of the deposition organicity film of an organic EL device, or an organic metal film, for example, and, specifically, there is the feature in having provided the thing means [like] below that the aforementioned problem should be solved.

[0015] 1. In the vacuum deposition equipment which uses the masking board equipped with the evaporation source crucible which makes an organic film deposit only on the specific part on a substrate, plasma was generated only around said masking board and only the organic film or organic metal film deposited at said masking board was removed in the vacuum. The shield board and shutter which confine plasma around said masking board have specifically been arranged, plasma was confined, and the electric power which makes a masking board generate plasma was supplied. It connected so that minus potential might be built over a

masking board. Since minus potential is built over the masking board, the organic film or organic metal film which oxygen ion deposited to the slot edge part of a surroundings lump and a masking board to the inside of a slot of a masking board is removable.

[0016] 2. In the vacuum deposition equipment which uses the masking board equipped with the evaporation source crucible which makes an organic film or an organic metal film deposit only on the specific part on a substrate, plasma was generated only around said masking board and only the organic film or organic metal film deposited at said masking board was removed in the vacuum. The shield board and shutter which confine plasma around said masking board have specifically been arranged, plasma was confined, and the electric power which makes an adhesion-proof board generate plasma further was supplied. And the bias potential of minus was supplied to the masking board. Since minus potential was built over the masking board, the organic film or organic metal film which oxygen ion deposited to the slot edge part of a surroundings lump and a masking board to the inside of a slot of a masking board was removable.

[0017] 3. It added to the organic film of the above 1 and 2, or the organic metal film removal means, and the shutter equipped with the structure of preventing penetration of oxygen ion in a crucible was attached to the upper part of an evaporation source crucible. Etching of an organic material in a crucible or organic metal material was lost by this shutter.

[0018] As the organic film used in this invention, or an organic metal film For example, others [compound / an organic phosphorus acid compound, an organic phosphorous acid compound, or / hypophosphorous acid], Hole pouring layer formation compounds indicated by JP,H11-8065,A, JP,H11-16677,A, etc., such as a hole move layer formation compound for organic electroluminescence, such as a metal OKISHINOIDO compound and tetra-ARIRUJI amine, or a metal phtalo SHINIANIN compound, are mentioned.

[0019] Moreover, as a masking board used by this invention, a stainless plate, a copper plate, an aluminum board, an argentic plate, etc. are mentioned, and they are 0.1mm - 1mm preferably 0.01mm - 10mm as thickness.

[0020]

[Working example] An example is given to below and this invention is concretely explained to it.

[0021] Example 1 drawing 1 is the schematic view showing one embodiment of the vacuum deposition equipment of this invention. In this drawing 1 , the masking board 101 is being fixed by the supporter material 106 which is an insulating material. The substrate 102 by which vacuum deposition processing was carried out is conveyed from the substrate taking-out entrance 114, and is removed by the conveyance mechanism 112 from the processing box which is the ground electrode 104 and serves also as an adhesion-proof board.

[0022] After the substrate 102 by which it was processed in the source 105 of organic vapor

deposition is removed, the masking board 101 connected to the power supply 107 is used as a cathode electrode, with the ground electrode 104 which serves also as an adhesion-proof board, from the gas inlet 111, oxygen is supplied and plasma is generated. Then, since plasma also reaches the source 105 of vapor deposition, a shutter 113 closes an opening. Plasma checked generating only to the electric discharge space 108 where the substrate 102 existed.

[0023] The masking board used for the example 1 at drawing 2 is shown. The electric discharge conditions which removed the organic film adhering to a masking board are as follows.

[0024]

Processing pressure power 133Pa electric discharge electric power 13.56MHz, 100W oxygen flux 50sccm processing time The test which carries out removal and evaluation of the organic film adhering to 10min masking board was carried out as follows.

[0025] After exhausting vacuum-chamber internal pressure power to Ix10 - 4 or less Pa, the crucible filled up with the organic material evaporation source is controlled at about 250 degrees C. It checks that vapor deposition speed is stabilized by a crystal type film thickness monitor (about 0.2 nm/s), a shutter is opened, and membrane formation is started. It checks that 0.3-micrometer film thickness has carried out film deposition by the crystal type film thickness monitor, and a shutter is shut. This film thickness was formed 10 times and the formed pattern was measured.

[0026] The total film thickness deposited on the masking board is about 3 micrometers. The masking board pattern for a test is shown in drawing 2 . In a hole, a 50-micrometer angle is made and, as for the hole interval, 30-micrometer patterning is made.

[0027] In the 1st membrane formation, after 10 times membrane formation became the error of the 46-micrometer angle - the 49-micrometer angle to the sedimentary layers of an organic material having formed membranes in the error span of the 49-micrometer angle - the 50-micrometer angle corresponding to the hole of the 50-micrometer angle of a masking board. Here, after the above-mentioned electric discharge conditions removed the organic film, membranes were formed again. As a result of measuring a pattern, the area of sedimentary layers was settled in the error span of the 49-micrometer angle - the 50-micrometer angle.

[0028] From this result, it can be judged that the organic film adhering to a masking board was removed by oxygen plasma. Moreover, since direct plasma electric power was impressed to a masking board, the surroundings lump of plasma was good and it was checked that film removal of the masking **** edge part had fully been performed.

[0029] Example 2 drawing 3 is the schematic view showing other embodiments of the vacuum deposition equipment of this invention. The masking board 301 is being fixed by the supporter material 306 which is an insulating material. The processed substrate 302 is conveyed from the substrate taking-out entrance 314, and is removed by the conveyance mechanism 312

from the processing box which is the plasma electrode 304 and serves also as an adhesion-proof board. The plasma electrode 304 is surrounded by ground potential with the shield box 315.

[0030] After the substrate 302 by which it was processed in the source 305 of organic vapor deposition is removed, the adhesion-proof board 304 connected to the power supply 307 is used as a cathode electrode, from the gas inlet 311, oxygen is supplied and plasma is generated. Then, since plasma also reaches the source 305 of vapor deposition, a shutter 313 closes an opening. The bias potential of the direct current 200V was impressed to the masking board 301. It checked generating plasma only to the electric discharge space 308 where the substrate 302 existed.

[0031] The masking board used for the example 2 at drawing 2 is shown. The electric discharge conditions which removed the organic film adhering to a masking board are as follows.

[0032]

Processing pressure power 133Pa electric discharge electric power 13.56MHz, 100W oxygen flux 50sccm processing time The test which carries out removal and evaluation of the organic film adhering to 10min masking board was carried out as follows.

[0033] After exhausting vacuum-chamber internal pressure power to Ix10 - 4 or less Pa, the crucible filled up with the organic metal material evaporation source is controlled at about 250 degrees C. It checks that vapor deposition speed is stabilized by a crystal type film thickness monitor (about 0.2 nm/s), a shutter is opened, and membrane formation is started. It checks that 0.3-micrometer film thickness has carried out film deposition by the crystal type film thickness monitor, and a shutter is shut. This film thickness was formed 10 times and the formed pattern was measured.

[0034] The total film thickness deposited on the masking board is about 3 micrometers. The masking board pattern for a test is shown in drawing 2 . In a hole, a 50-micrometer angle is made and, as for the hole interval, 30-micrometer patterning is made.

[0035] In the 1st membrane formation, after 10 times membrane formation became the error of the 46-micrometer angle - the 49-micrometer angle to the sedimentary layers of organic metal material having formed membranes in the error span of the 49-micrometer angle - the 50-micrometer angle corresponding to the hole of the 50-micrometer angle of a masking board. Here, according to the above-mentioned electric discharge conditions, after removing an organic metal film, membranes were formed again. As a result of measuring a pattern, the area of sedimentary layers is ******** to the error span of a 49-micrometer angle - a 50-micrometer angle.

[0036] From this result, it can be judged that the organic metal film adhering to a masking board was removed by oxygen plasma. Moreover, since bias potential was impressed to a

masking board, the surroundings lump of plasma was good and it was checked that film removal of the masking **** edge part had fully been performed.

[0037] Example 3 drawing 4 is the schematic view showing the structure of the shutter for preventing radical penetration of etching gas to an evaporation source. A shutter board for an evaporation source and 402 to prevent radical penetration of etching gas 401, The axis of rotation for the arm on which 403 supports SHATA, and 404 to rotate a shutter, The seal member to which 405 carries out the vacuum seal of the axis of rotation, the bellows which carries out the seal of the axis of rotation in which 406 moves up and down, A motor for coupling for 407 to connect the motor and the axis of rotation which are the rotational source of power, and 408 to rotate a shutter, and 409 show the air cylinder for making a shutter go up and down.

[0038] With the plasma of oxygen, when etching the organic film adhering to a masking board, a shutter 402 is closed, the air cylinder 409 is lowered, a shutter 402 is stuck to an evaporation source, and penetration of an oxygen radical is prevented. By this shutter 402, while carrying out film removal by oxygen plasma, it was lost that an organic material in an evaporation source crucible is etched.

[0039]

[Effect of the Invention] The effect which was explained above and which is taken below like according to this invention is acquired.

1) Since an organic film or an organic metal film can be removed easily and cleaning becomes possible each time after membrane formation, as shown in the example, the good patterning accuracy of reproducibility is acquired.

2) The cycle which carries out air opening of the vacuum chamber is prolonged. Compared with the time of there being no cleaning mechanism at least, it extends [in the injection cycle of material] in 2 to 3 or more (it changes with the amounts of injections and film thickness of material) times that what is necessary is just to carry out air opening of the vacuum chamber. 5 hours and a total of 9 hours are taken to return it to the state (states, such as vacuous pressure and moisture) where membranes can be formed, once opening a vacuum chamber wide to the atmosphere to the vacuum exhaust air after baking powder by vacuum exhaust air for baking powder 3 hours for 1 hour. In order that the number of times which needs this time may decrease, manufacturing efficiency improves.

[0040] 3) In order not to remove a mask at the time of a maintenance, position adjustment of a mask is only a time of setting first, and the position adjustment mechanism of a mask becomes unnecessary. Although a mask position adjustment mechanism differs in a price with a method and form, it serves as a large cost cut.

4) Although the time which the mask position adjustment at the time of mask exchange takes is required per time for about 4 hours, it becomes unnecessary [this time].

5) Since it has the shutter which prevents radical penetration of etching gas to an evaporation source crucible, don't remove to the material in a crucible.

[Translation done.]